Northeast Coastal and Barrier Network
Protocol Development Summary
(Sept. 2005)

Protocol: Ocean Shoreline Position

Parks Where Protocols will be Implemented: ASIS, CACO, COLO, FIIS, GATE, GEWA, SAHI

Justification/Issues Being Addressed:
The problem of land loss/gain and landscape alteration at the marine edge is fundamental to the many issues facing coastal park resource stewards. Shoreline change is a prime geo-indicator of coastal environmental resource threats within parks. Change in shoreline position drives the alteration and replacement of established natural habitats and shoreline retreat may destroy cultural resources, facilities, and other infrastructure where they exist. Geomorphologic change is a basic concern because it also drives change in other natural resource areas of interest within the NPS program: water quality in ground and in estuaries, species and habitats of concern, recreational visitor use, and even resource extraction. Spatial variability is inherent in shoreline change. Early identification of changes in past trends, along with an understanding of normal variability, is key to recognition of ecological problems in coastal parks. For managers, an understanding of the spatial and temporal patterns of geomorphologic change is basic to optimal management of any coastal park because: 1) the interface of marine and land systems is very dynamic and is driven by multiple forcing mechanisms, 2) it results in alterations to resource patterns and dynamics at habitat and ecosystem level, and 3) it will eventually result in the loss of static resources. Developing an understanding of these effects would benefit from the establishment of local long term monitoring programs.

The primary geomorphologic variables operating in northeastern coastal parks are sea level rise, wave climate, and sediment supply. All eastern coastal parks are adversely affected by a relative rise in sea level (roughly 0.2-0.3 m in the last century). Although slow, this is a chronic driving force. Substantial shoreline retreat is also driven by aperiodic storms (tropical cyclones in summer and mid-latitude nor'easters in the winter). Storm effects upon the beach may be ameliorated within a week or two but if the system is degraded, a decade of storm quiescence may be needed for recovery. Furthermore, almost all-coastal locations have a declining sediment supply that contributes to coastal erosion. In addition to the primary variables, local conditions also control rates and direction of change. These include the geologic framework, offshore topography, orthogonal fetch limitations, and local sediment sources and sinks.

In addition to global, regional, and local natural causes, many cases of coastal erosion are accelerated by human perturbations to the natural system. Specific changes to tides, waves, currents, and availability of sediment have profound morphological and ecosystem feedback. Examples range from stabilized inlets, seawalls, and groins, to hardened shorelines for inland protection, and beach and dune rebuilding with added sand from an external source. Habitat and ecosystem responses to such changes are not well understood by ecologists, and how long these impacts persist are virtually unknown at the local level.

A complete understanding these processes requires an adequate measurement of the hydrodynamic forcing of sediment transport, morphologic change, and ecosystem response at the level of the individual park unit. These are very complex tasks, which are beyond the capability of the National Park Service to perform alone. Acquiring some of this information will require concentrated cooperative effort between the NPS and other federal, state, and local agencies with significant coastal mandates. There are however, several measurable indicators and expressions of overall coastal process that can be monitored at the individual park level. Some of these methods are well established and can be implemented quickly while others involving rapidly emerging technologies will require additional research and testing to develop.

Monitoring Goals, Questions and Objectives to be addressed by the Protocol:
NCBN Goal:
To improve the understanding of and provide information to park managers on the dynamic nature of coastlines, including the spatial and temporal patterns of change in NCBN parks for use in management decisions and describing the condition of marine and coastal areas.

Monitoring Questions:
What is the spatial and temporal variability in shoreline position?

Monitoring Objective 1:
Determine long-term trends in the seasonal and annual variability in shoreline position for the ocean shoreline in network parks.

Monitoring Objective 2:
Characterize and improve understanding of how long-term trends in marine hydrodynamic processes (tide, current and wave), offshore topography (sediment quality, bathymetry and location of migrating shoals and bodies) and the location of man-made structures influence NCBN park beach/dune systems.

Vital Sign:
Shoreline position

Measure:
Shoreline position

Justification:
Changes in shoreline position are a well established and readily measurable expression of the complex set of processes that drives the morphology of coastal features. Shorelines are highly variable features that require long term (decade and century scales) data sets to establish significant trends. Because the GPS shoreline survey uses the mean high water mark (wet/dry) as its target feature, it is compatible with both hydrographic survey and photogrammetric shorelines that approximated the mean high water mark and that span

150 years in many places. GPS technology is also available and useable at the park level making it a highly

Basic Approach:
To determine park-wide trends in shoreline movement, a sampling design that includes all ocean shorelines and selected sandy beach bay/estuary areas will be used. Differential GPS (DGPS) will be used to survey the beach high water mark (wet/dry line) following a neap high tide under normal weather conditions. In order to capture extreme seasonal variability, a late summer and late winter survey are prescribed. The GPS is configured for sub-meter data collection and to record points at all times (i.e., including times when radio-link is lost), so that post-processing is possible if required to correct position data. Surveys along the ocean shoreline are accomplished by driving a four wheel ATV or similar vehicle at a relatively constant speed (between 5 and 10 mph) along the high tide line. For the purposes of this monitoring program, the actual ocean 'shoreline' is defined as the position of the most recent high tide, evidenced by the obvious wet/dry sand line or deposited wrack. The GPS receiver is configured to record positions at a very short interval (typically one position every 2 seconds) for the best representation of the shoreline position. Data is downloaded from the GPS for inspection and editing, processed, and documented according to currently accepted FGDC standards for coastal data.

Principal Investigators and NPS Lead:
Protocol development will be completed through cooperative agreement with Rutgers University.
Principle Investigators: Dr. Norbert Psuty and Jeff Pace
NPS leads: Mark Duffy

Development Schedule, Budget, and Expected Interim Products:
The draft ocean shoreline position protocol was completed in October, 2005. The total amount of funding obligated by the Network to this agreement as of FY 2005 is $112,113.